

Short Communication

Notes on the status and incidental capture of marine turtles by the subsistence fishing communities of South West Madagascar

Ryan C.J. Walker^{1,3} and Emily Roberts^{2,3}

¹Oak House Pond lane, Greatham, Rutland, LE15 7NW, UK; ²1 Church Row, Stratton on the Fosse, Somerset BA3 4QT, UK; ³The Society for Environmental Exploration, 50-52 Rivington Street, London, EC2A 3PQ, UK

Key words: Turtles, artisanal fisheries, Madagascar

Abstract—This paper investigates incidental capture and the egg harvesting of five species of turtle by eight subsistence fishing communities in south west Madagascar. Data were collected through semi-structured interviews with fishers from each community over a period of three weeks during March 2002. Turtles were captured as part of a seasonal, multi-species fishery using spear guns and shark gill nets. Capture rates varied widely during the peak fishing season of October to March with respondents from the village of Maromena reporting monthly anecdotal capture rates of approximately 300 individuals. Green turtles (*Chelonia mydas*) were the most commonly caught species. The reporting of continued diminishing turtle catch levels over the last 10 years by the fishers contributed to the reduction in the cultural dependence on turtles and their use in ceremonies. Known nesting populations of green turtles have been reduced by 70%, and hawksbills *Eretmochelys imbricata* by 50%, since 1991. Recommendations include: further research on turtle status, distribution and threats; environmental education; development of sustainable alternative livelihoods; and development of appropriate protective measures.

INTRODUCTION

Subsistence coastal fisheries, common throughout the western Indian Ocean, exploit a wide range of fin fish species, but also less sustainable target taxa such as elasmobranchs, dolphins, dugongs, turtles and even sea birds and eggs (Cooke *et al.* 2000). Madagascar, the fourth largest island in the world has a coastline of approximately 6000km (McClanahan *et al.* 2000) with a high proportion of the human population living close to the coast. Dependence on coastal resources is evident by the high levels of fishing activity, principally from non-motorised traditional boats (Macia & Hernoth 1995, Cooke *et al.* 2000). Harvesting of marine products has been estimated at 117,500 tonnes annually, of which 55% is captured by small scale,

artisanal and subsistence fisheries (McClanahan *et al.* 2000).

Five species of turtle inhabit Madagascar's coastal waters, green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), loggerhead (*Caretta caretta*), olive ridley (*Lepidochelys olivacea*) and leatherback turtles (*Dermochelys coriacea*) (Rakotonirina & Cooke 1994). All but leatherback turtles are known to nest on the beaches of Madagascar. The conservation of turtles is of global importance, due to significant declines of all species over the past three decades. A number of anthropogenic causes such as fisheries bycatch (Ehrenfeld 1982), habitat destruction (Rakotonirina & Cooke 1994, Meyland & Ehrenfeld 2000), pollution, disease and over-exploitation of adults and eggs (Kar & Bhaskar 1982, Rakotonirina &

Cooke 1994) have contributed to the decline. All seven species of turtles are listed as Endangered, Critically Endangered, or Vulnerable by the World Conservation Union (IUCN), and all are listed in Annexe 1 of the Convention on International Trade in Endangered Species of wild flora and fauna (CITES). International trade in turtle products is therefore prohibited by CITES but continues, particularly by Japan and other South East Asian countries (Rakotonirina & Cooke 1994).

The Vezo, a sea faring ethnic group, indigenous to the south west coastal region of Madagascar, have a long history of subsistence turtle exploitation and associated cultural traditions (Rakotonirina 1989, Rakotonirina & Cooke 1994). Turtles are protected by local law, under Decree 24 passed in 1923, but this law has seldom, if ever been enforced. The low reproductive potential and delayed sexual maturity of turtles make all species unsuitable for intensive harvest. Even as far back as the early twentieth century, Petit (1930) reported the importance of turtles to Malagasy fisheries. Hughes (1974) pointed to the apparent decline in numbers of the hawksbill turtle and the disappearance of nesting populations. Rakotonirina (1987) reported declines in numbers of nesting green, loggerhead and hawksbill turtles. Groombridge & Luxmoore (1989) carried out a comprehensive review of the available literature on green and hawksbill turtles and observed the virtual lack of data on nesting sites for each species in Madagascar. Ratotonirina & Cooke (1994) state that the raiding of nests and hunting for meat and carapaces are believed to be the fundamental causes of declines for four of the five species in the region.

No comprehensive research on the level of turtle exploitation has been undertaken for 10 years in the south west of Madagascar, but Walker *et al.* (2004) show there is a trade network dealing turtles within this region of Madagascar. Fishers sell live turtles to dealers and dealers in turn sell slaughtered, or parts of slaughtered turtles on to traders for purchase and consumption by the general public. Previous research suggests the activity to be unsustainable (Rakotonirina & Cooke 1994, Kar & Bhaskar 1982), with negative implications for turtle populations of the western Indian Ocean. Our study aims to document the

present level of turtle capture and exploitation and the cultural value of turtles within eight Vezo communities in south west Madagascar.

METHODS

This study centres on the incidental turtle fishing effort of the eight coastal communities from Anakao, stretching 60km south to Ambola (Fig. 1). The study area is bordered by the Onilahy River

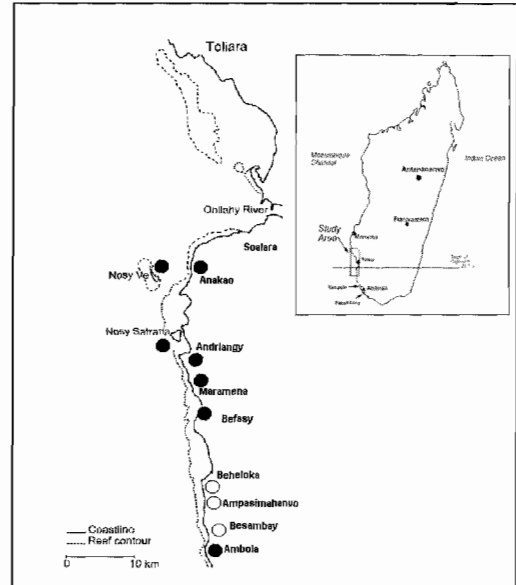


Figure 1. Map of the south west region of Madagascar, from Toliara to Ambola, with shaded dots showing former marine turtle nesting sites. Unshaded dots represent existing nesting sites

estuary in the north and consists of the near shore waters dominated by the Anakao fringing reef system and the two small islands of Nosy Ve and Nosy Satrana.

Data were collected through semi-structured interviews with the fishers from the eight communities over a period of three weeks during March 2002. Several days were spent in each village with a formal introduction initially given to the village leader or leaders outlining the nature and aims of the work. A formal gathering would then be organised with the aim of trying to attract all the fishers from the community for interview. Approximately 200 fishers in total were interviewed in groups within each village, as this

was deemed to be the most comfortable situation for those being interviewed (a translated list of questions is listed in Appendix 1). As well as the formal questioning, fishers were encouraged to share any interesting or unusual stories of their time catching turtles and the cultural significance of turtles within the village. All interviews were conducted in Malagasy.

RESULTS

No fishers reported targeting turtles exclusively; with all captured animals being incidental catch within a multi-species reef fishery or artisanal shark fishery. Gear types used were reported as shark gill nets, locally referred to as *jarifa*. Six fishers in Anakao had access to spear guns and as a result used these to catch turtles too. Consistent with many subsistence fishing practices, turtle catches were highly seasonal. Fishers generally avoided fishing from April to September when rough sea conditions made it difficult to operate their small traditional sailing pirogues, with peak incidental turtle capture occurring from October to March. Some communities reported long stretches of time between April and September when no turtles were captured. For example, Ambola reported not catching any turtles for three months, and Andriangy only reported an annual capture rate of three individuals. The fishers of Ampasimahonvo were not planning on fishing at all with gill nets until the warmer months of October to March. Fishers sold their turtle catch

to dealers in Anakao or Toliara. Maromena contributed the largest catch levels, with respondents giving a monthly anecdotal capture rate of approximately 300 individuals (Table 1) during the peak fishing season. Previous fishing success was also evident by the thousands of turtle bones littering the beach in front of the village.

Catch composition

Each of the eight communities reported the capture of green and loggerhead turtles, with olive ridleys also caught in all communities except Befasy and Andriangy. Hawksbill turtles were reported in all communities except Anakao, whilst leatherbacks were caught by the fishers of Beheloka, Maramena, Ambola, Besambay and Ampasimahonvo (Table 1). Fishers claimed that green turtles were the most abundant species caught in the region. Leatherbacks are reported as the least common species captured, but when encountered are normally of considerable size, for example fishers in Ambola report animals of 400 to 500 kg.

Cultural value

The Vezo people of south west Madagascar have a strong history of turtle exploitation and associated cultural traditions (Rakotonirina, 1989). The practices involved in turtle fishing include offerings and ceremonies to the ancestors, blessing the hunting spear and dictating whom may eat the meat. These have begun to fade, with only three

Table 1. Incidental turtle catch rate data for the 8 villages in the region

Village	Capture rate per month (peak season)	Species encountered by fishers	Number of fishers per village
Anakao	2 - 3	CM, LO, CC,	27
Ambola	60 -70	CM, LO, CC, EI, DC	*
Ampasimahonvo	4 - 6	CM, LO, CC, EI, DC	6
Besambay	60 -70	CM, LO, CC, EI, DC	16
Befasy	32	CM, LO, EI	*
Maramena	300	CM, LO, CC, EI, DC	120
Andriangy	3 (per year)	CM, LO, EI	4
Beheloka	40 -60	CM, LO, CC, EI, DC	10

* = Data unavailable

CM=green, LO=olive ridley, CC=loggerhead, EI=hawksbill, DC=leatherback

out of eight villages (Ambola, Maromena and Beheloka) supporting fishers who use Ombiasy (spiritual leaders and healers) to bring them luck when fishing. Although the traditions are still known, there is little adherence by the younger generation, evident by fishers' claims that the number of turtles caught was a result of the methods used, rather than luck derived by spiritual means. The use of traditional turtle harpoons has been replaced by spear guns and gill nets. Respondents generally stated that spear gun fishing by free diving is a difficult activity requiring much skill, similar to the traditional practice of using a harpoon. Gill net fishing on the other hand is passive and requires less effort on behalf of the fisher and is thus the preferred method.

Population status

Fishers and representatives from all eight communities involved in this study stated that turtle catch levels and general abundance had decreased progressively over the last 10 years. The fishers in Anakao stated a four-fold decrease in the number of turtles captured over the last 10 years.

Figure 1 and table 2 shows the present and former nesting sites of the four species of turtle most commonly exploited in the region. Nesting activity on the beaches near Ampasimahonvo has declined over the past 10 years to just one green turtle nesting during 2001. Nesting turtles were rarely seen in the Anakao area now, with hawksbills

last seen on Nosy Ve in 1997. Fishers in Besambay reported seeing green turtles and loggerheads nesting to the south of the village and hawksbills to the north, every year between October and December. Villagers in Maromena reported the nesting of loggerheads in December, raiding the nests for eggs each year. No turtles have nested near Befasy since the last loggerheads seen north and south of the village in 2000.

Local perceptions of turtle status

Some aspects of turtle biology were generally well understood by those exploiting them. For example the local turtle population's nesting patterns appear to be understood, resulting in most individual turtle nests on beaches close to the villages being raided on an annual basis, as villages knew when to expect them. But some aspects of turtle biology and ecology are misunderstood, for example fishers from Befasy claimed that individuals that used to be seen nesting on the land close to the village have a fear of people, causing them to nest in the sea. The fishers attributed reduced catch levels in general to turtles becoming "clever" and avoiding capture as opposed to a population decline. When questioned about the local abundance and status of leatherbacks, the fishers in Beheloka claimed that the species was never seen locally due to them nesting in the sea as opposed to other species which nest on the beaches.

Table 2. Reported marine turtle nesting sites SW Madagascar in 1991 and 2002; data taken from Durbin & Rakotonirina (1991) and interviews in this study

Locality	Green turtle		Hawksbill turtle		Loggerhead turtle		Olive ridley turtle	
	>1991	2002	>1991	2002	>1991	2002	>1991	2002
Itampolo	a							
Beheloka	a	a						
Anakao	a		a		a			
Ambola	a							
Andriany	a							
Ampasimahonoro	a	a						
Besambay	a	a	a	a	a	a		
Maromena						a		
Nosy Ve	a							
Befasy	a							
Nosy Satrana	a							

DISCUSSION

Previous research by Rakotonirina & Cooke (1994) split turtle fishers in the region into two categories; incidental or occupational fishers. During the present study, only the incidental fishers existed due to diminishing catch levels making it economically unviable to solely target turtles. Historically, green turtles were the commonest species exploited (Rakotonirina & Cooke 1994), consistent with results of the present study. The decline in turtle catch levels over the last 10 years appears to have followed on from the decline documented by Rakotonirina & Cooke's (1994) study, suggesting an on-going gradual decline in local turtle populations. This trend maybe cause for concern given that Rakotonirina & Cooke (1994) stated that the barrier reefs of Toliara are an important feeding ground for green turtles and probably at one time supported the largest populations of this species in Madagascar.

Marine resource utilisation has grown at an alarming rate in the region (DRH/FAO, 1992), mainly, as a result of migration to coastal areas due to high unemployment and crop failure amongst inland communities. Cooke *et al.* (2000) reported a 324% population increase in the Toliara region between 1975 and 1993. This ever increasing population pressure has lead to local marine and coastal resource depletion, as resources such as turtles become scarcer. Therefore, more reliable and intensive methods of hunting turtles have replaced the traditional methods and gears, contributing to the customs that were once ubiquitous with traditional turtle hunting becoming disregarded. Result suggests that while some older fishers in the region still follow certain traditions associated with turtle exploitation, in general, these are at best becoming diluted and at worst ignored completely by the younger generation of fishers. The most overwhelming evidence for this is the disregard of the traditional turtle fishing harpoon in favour of more modern gear types.

Previously, there were nine green, two hawksbill and two loggerhead turtle nesting populations in the area (Durbin & Ratokotoniana, 1991). Of these, respondents indicated that only three of the green and one of the hawksbill nesting populations remain. Two sites were still utilised

by loggerheads, one near Basamby and the other at Maromena. Elsewhere in Madagascar, in the Mahajanga region on the north west coast, *fady* (traditional beliefs the local population must adhere to) dictated that collectors must leave between 1 and 20 eggs in the nest (Durbin & Rakotoniana, 1991; Durbin & Ralambo, 1994). Unfortunately not even this token gesture of sustainable resource management was practiced by the turtle egg collectors in the south west.

Rakotonirina & Cooke, (1994) state that fishers in Fitsitike, Morondava (both north of Toliara) and Anakao reported green and hawksbill turtles releasing eggs into the sea where beaches were plentiful. Siegel (1991) reports similar observations by fishers from Itampolo (south of Ambola), stating that this phenomenon could be due to the females being unable to find a suitable nest site, possibly due to continued disturbance by egg collectors and local human communities. These statements are consistent with claims made by fishers in Befasy, of turtles releasing eggs into the sea and warrants further investigation to establish if this is indeed a response to nesting disturbance or a myth.

The marked reduction in the catch levels of all five species of turtle suggests that the local fishers are having a detrimental effect on the green, hawksbill, loggerhead and olive ridley turtle populations in the south west Indian Ocean. However, other factors also need to be considered, such as high seas fishery turtle bycatch, or disturbance of nesting sites in Madagascar and elsewhere in the western Indian Ocean. Catching turtles is a lucrative occupation for the local fishers concerned, with a large green turtle selling for approximately US\$20, the equivalent to almost one months equivalent reef fishing effort (Walker *et al.*, 2004). One positive aspect is that large stretches of Madagascar's south western and southern coastline are sparsely inhabited due to a lack of fresh water and may support potentially unknown nesting populations - an obvious focus of further research.

Clearly a management strategy needs to be put in place, even though this may mean introducing policies that cause cultural dilution. Sustainable alternative livelihoods need to be developed to reduce pressure on local coastal fisheries, which

are showing signs of over exploitation (Laroche & Ramananarivo, 1995, Cooke *et al*, 2000). In Beheloka for example, small-scale algae (*Eucheuma*) aquaculture had recently been developed in the intertidal lagoon in front of the village, and sold to a dealer in Toliara. This, along with the determination of the potential exploitation of pelagic fish stocks are areas that warrant further investigation. However, should such development be encouraged, there would be a need to be sufficient funding to provide the population of this impoverished stretch of coastline with the necessary equipment and fishing gear. In order to ascertain the population status and distribution of the five species of turtle that inhabit the region, more specific research is needed. Priority research includes identifying areas important for turtle populations, such as nesting beaches and feeding grounds, and investigating appropriate protective measures. Bille & Mermet (2002) state that small-scale community based integrated coastal zone management has always had a greater record of success in Madagascar than larger national or regional policies. The integration of environmental education, local public awareness and habitat protection, combined with the provision of sustainable alternative incomes for fishers, is one approach that could result in a workable turtle management program for the area.

Acknowledgements—Thanks is extended to The Society for Environmental Exploration (SEE) logistical staff especially Jemima Stancombe, Sarah de Mowbray, Sander den Haring and our collaborative organisation: The Institute of Marine Sciences, University of Toliara, Madagascar. Thanks to the self-funding volunteer research assistances. Most importantly thanks to all Malagasy, fishers and turtle dealers involved in the turtle trade in the Toliara region for their patience and support.

REFERENCES

- Bille, R. & Mermet, L. (2002) Integrated coastal management at the regional level: lessons from Toliara, Madagascar. *Ocean and Coastal Management*. 45: 41-58.
- Cooke, A., Ratamahenina, O. & Ranaivoson, E. (2000) Madagascar. In *Seas at the Millenium*. (eds C. Shepard), 103-119p. Elsevier Science Press, New York.
- DRH/FAO. (1992) *Pêche et aquaculture à Madagascar*. Rapport. DRH/UNDP/FAO.
- Durbin, J. & Ralambo, J.A. (1994) The role of local people in the successful maintenance of protected areas in Madagascar. *Environmental Conservation*. 21, 115-120.
- Durbin, J. & Rakotoniana, L.J. (1991) *Project Angonoka, Local People and Conservation in the Soalala Region*. unpublished report.
- Ehrenfeld, D. (1982) Options and limitations in the conservation of sea turtles. In *Biology and Conservation of Sea turtles*. (eds K.A., Bjorndal), pp.605-609. Smithsonian Institution Press, Washington.
- Groombridge, B. & Luxmoore, R. (1989) *The Green Turtle and Hawksbill, World Status, Exploration and Trade (Madagascar)*. pp.700-805. UNEP. Report prepared for CITES.
- Hughes, G.R. (1974) *The Sea Turtles of South East Africa. 1. Status, Morphology and Distribution*. Investigation report of the Oceanographic Research Institute, Durban South Africa.
- Kar, C.S. & Bhaskar, S. (1982) Status of sea turtles in the eastern Indian Ocean. In *Biology and Conservation of Sea Turtles*. (eds. K.A. Bjorndal), pp.365-372 Smithsonian Institute Press, Washington.
- Laroche, J. & Ramananarivo, N. (1995) A preliminary survey of the artisanal fishery on coral reefs of the Tulear Region (southwest Madagascar). *Coral Reefs*, 14, 193-200.
- Macia, A. & Hernoth, L. (1995) Maintaining sustainable resource and biodiversity while promoting development, a demanding task for a young nation. *Ambio*, 24, 515-517.
- McClanahan, T.R., Sheppard, R.C. & Obura, D.O. (2000) *Coral Reefs of the Indian Ocean: Their Ecology and Conservation*, Oxford University Press. 550p.
- Meyland, A.B. & Ehrenfeld, D. (2000) Conservation of Marine Turtles. In *Turtle Conservation* (ed. M.W. Klemens) 96-125p Smithsonian Institution Press, Washington.
- Petit, G. (1930) *L'Industrie des Pêches à Madagascar*. Société des Editions Géographiques, Maritimes et Coloniales, Paris.
- Rakotonirina, B.P. (1987) *Les tortuse marines dans le sud de Madagascar: Etude Bibliographique et enquetes aupres des pecheurs. Recherche sur la biometrie et l'alimentation de la tourtue verte*,

Chelonia mydas Linnaeus. Memoire de DEA d'Océanographie Appliquée, Université de Toliara.

Rakotonirina, B.P. (1989). *Exploitation des Tortues Marines a Madagascar*. Rapport d'enquêtes, 1989. Unpublished report IHSM.

Rakotonirina, B.P, Cooke, A. (1994). Sea turtles of Madagascar - their status, exploitation and conservation. *Oryx*, 28, 51-61.

Siegel P. (1991) WWF Marine Programme, Southern Madagascar Trip Report. 15-26 Sept 1991. Unpublished Report, World Wide Fund for Nature.

Walker, R.C.J., Roberts, E. & Fanning, E (2004) The trade in marine turtles in the Toliara region, south west Madagascar. *Marine Turtle Newsletter*. 106: 7-10.

APPENDIX 1

1. What species do you catch (numbers, seasonal trends)
2. What gears do you employ (number of each gear per community, number of fishers).
3. What is the fate of the catch (who buys it or consumes it)
4. How many turtles (total and species) have you caught in the last month
5. Where were they sold
6. Are they important to you
7. In what way (economically/ culturally)
8. How have catch levels changed over the last 10 years
9. Have you ever seen turtles nesting, if so location of local nest sites.